

EXTRACT TM 11-2059

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual covers the installation, operation, and maintenance of Telephone TP-9 and Telephone Set TA-264/PT.

b. Forward any comments on this publication direct to Commanding Officer, U. S. Army Signal Publications Agency, Fort Monmouth, N. J.

c. Throughout this manual, the term *telephones* will be used to identify Telephone TP-9 and Telephone Set TA-264/PT.

2. Forms and Records

a. *Unsatisfactory Equipment Reports.* Fill out and forward DA Form 468 (Unsatisfactory Report to Commanding Officer) Signal Equipment Support Agency, Fort Monmouth, New Jersey, as prescribed in AR 700-38.

b. *Damaged or Improper Shipment.* Fill out and forward DD Form 6, (Report of Damaged or Improper Shipment) as prescribed in AR 700-58 ((Army); Navy Shipping Guide, Article 1850-4 (Navy); and AFR 71-4 (Air Force)).

c. Preventive Maintenance Forms.

(1) Prepare DA Form 11-240 (fig. 5) (Operator First Echelon Maintenance Checklist for Signal Corps Equipment—Telephone Set) in accordance with instructions on the back of the form.

(2) Prepare DA Form 11-241 (fig. 6) (Second and Third Echelon Maintenance Checklist for Signal Corps Equipment—Telephone Set) in accordance with instructions on the back of the form.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

The telephones are used to extend the range and improve the quality of long field wire circuits where it is not feasible to install and maintain repeaters. They are used at terminals (and at intermediate points between terminals) of a 2-wire line. When used in this way, and noise and cross talk conditions permit, the telephones approximately double the transmission range obtained with ordinary local battery sets. Although the telephones are used primarily on field wire circuits, they may be used with other line facilities. The transmission ranges differ with the characteristics of the line. Best results are obtained when a Telephone TP-9 or Telephone Set TA-264/PT is used at each end of the line.

4. Technical Characteristics

Power supply..... Dry batteries:
One Battery BA-65 (or
BA-35), 1½ volts.

One Battery BA-27, 4½-
volts.
Three Batteries BA-2,
22½ volts.

Current drain..... 255 ma.
Number of tubes..... 4 (1 spare).
Operating temperature..... —60° F. to 132° F.
limits.
Frequency range..... 400 to 3,500 cps.

Power levels:

Transmitting..... 23 dbm (maximum).
Sidetone..... —20 dbm to —35 dbm at all
frequencies in the 400 to
3,500 cps range, when out-
put at the line terminals is
+13 dbm into a 600-ohm
resistor.

Range..... 65 db circuits (maximum).
Impedance..... 600 ohms ±10 percent.

Gain:

Transmitter..... 15 db.
Receiver..... 55 db.

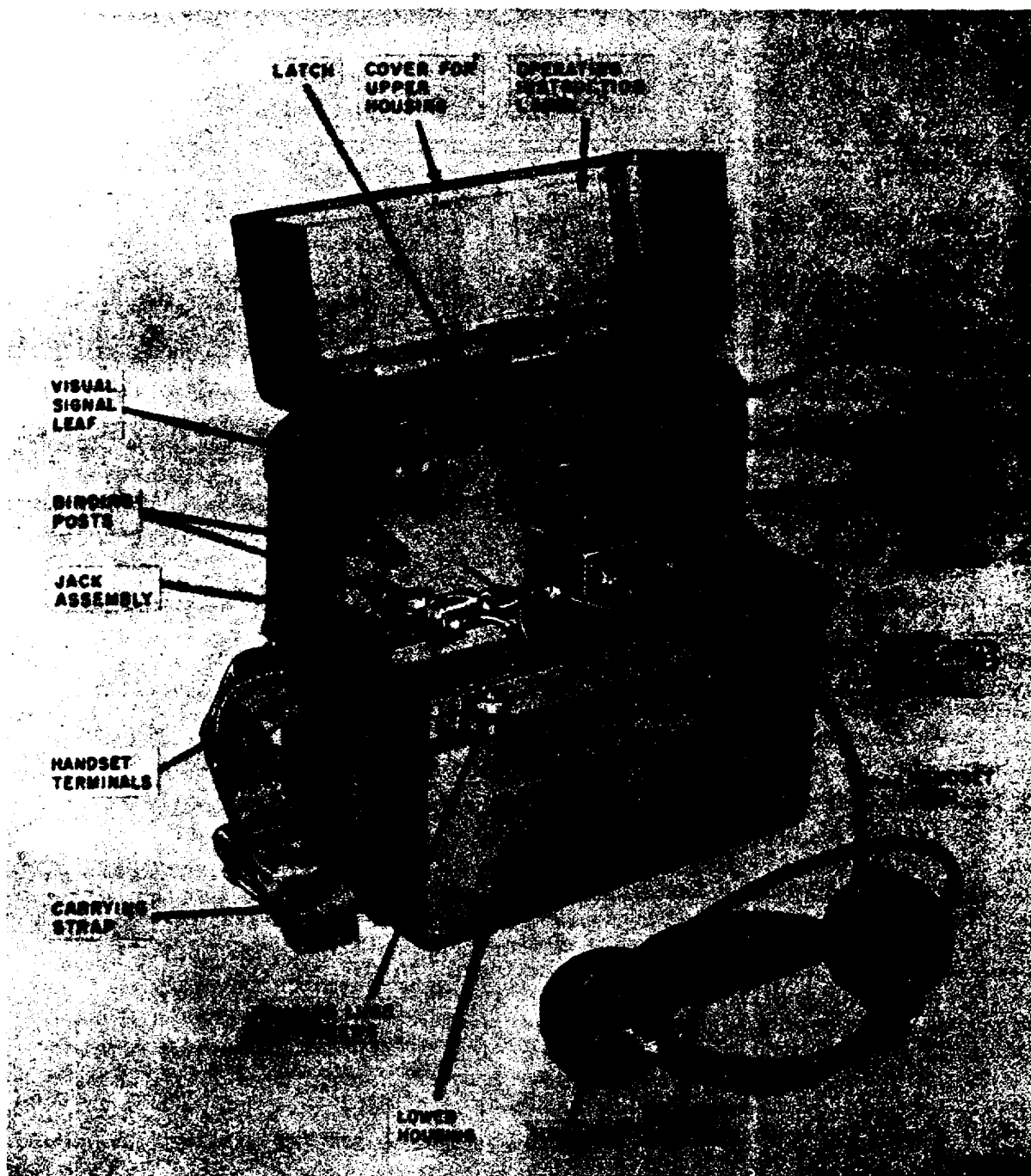


Figure 2. Telephone TP-9, upper housing open.

5. Components

The telephones are self-contained units consisting of a handset, generator, ringer, and amplifiers. A spare tube (3Q5GT/G) is mounted on the tube mounting board. Two technical manuals are provided with each equipment.

6. Description (fig. 2)

a. Each telephone consists of an upper housing, lower housing and a hinged cover. The upper housing mounts all the operating components. The handset and control equipment extend beyond the upper housing and are inclosed by the hinged cover. The amplifier and the batteries extend below the upper housing and are inclosed by the lower housing. The generator crank extends through the side of the upper housing. When not in use, the crank folds into a recess provided for this purpose. When assembled, the telephones are made waterproof by a composition gasket separating the upper and lower housings and by gaskets protecting the openings for the generator crank, binding posts, switches, and controls.

b. Operating power is furnished by batteries located in the lower housing.

c. The telephones are provided with a bell for audible signaling and with a visual signal leaf for noiseless signaling. A switch is provided to select either type of signaling.

7. Additional Equipment Required

a. The following equipment is not supplied as part of the telephones but is required for operation:

- (1) One 4½-volt Battery BA-27 for the transmitter and relay power supply.
- (2) Three 22½-volt Batteries BA-2 for the plate voltages.
- (3) One 1½-volt Battery BA-65 (or BA-35) for the filament power supply.

Note. Under normal conditions of intermittent operation, the batteries should last about 3 or 4 weeks. However, this period will vary with climatic and operating conditions.

b. To insure the satisfactory performance of the telephones in temperatures as low as -60° F. when operation of this equipment is essential, substitute the above batteries as follows:

- (1) The three Batteries BA-2 with low-temperature Batteries BA-2002/U.
- (2) Battery BA-27 with Battery BA-2027/U.
- (3) Battery BA-65 with Battery BA-2065/U.

8. Differences in Models

All Telephones TP-9 are similar in purpose, operation, and appearance. Telephones TP-9, serial numbers above 9266 include slight improvements in circuitry and a newer hand ringing generator. Telephone Sets TA-264/PT are similar to the TP-9, serial numbers above 9266.

CHAPTER 2

INSTALLATION AND OPERATION

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

9. Siting

Select a site close to the base of operations, free from dust, dirt, and excessive moisture. Place the telephone on a convenient work bench or table, near enough to the signal lines so that connections can be made easily.

10. Unpacking

a. Packaging Data. When packed for export shipment, the telephones are placed in a close-fitting, water-resistant, fiberboard box, sealed with pressure sensitive tape. The telephone is adequately cushioned within the fiberboard box. The approximate weight of the packaged units is 19 pounds and displaces about 1,230 cubic inches. Varying quantities of telephones are packed within a nailed wooden box. Shipping containers are reinforced with steel strapping, generally applied girthwise.

b. Removing Contents. Be careful when unpacking equipment. Do not thrust tools into the interior of the shipping container; this procedure

may damage the equipment. Follow the steps given in (1) through (5) below:

- (1) Place the packing case on a secure flat surface.
- (2) Cut the steel straps.
- (3) Remove the nails, using a nail puller, and remove the sides and top of the packing case. Do not pry the sides and top off. This procedure may damage the equipment.
- (4) Lift out the corrugated fiberboard box containing the equipment.
- (5) Slit the taped seams of the corrugated fiberboard box and lift out the telephone.

11. Checking

- a.* Check the contents against the packing slip.
- b.* Examine the equipment carefully for possible damage during shipment.
- c.* Report damaged equipment in accordance with instructions contained in paragraph 2.

Section II. INSTALLATION

12. Preparation for Use (figs. 3 and 4)

a. Before the telephones can be installed for use, batteries (par. 7) must be installed and connected as outlined in (1) through (10) below.

- (1) Unfasten the four screws which hold the upper and lower housings together (fig. 2). Turn the equipment upside down and separate the housings.
- (2) Unfasten the two battery clamping frame screws and remove both battery clamping frames (fig. 3).
- (3) Install Battery BA-27 in the position shown in figure 3.

- (4) Replace the center battery clamping frame.
- (5) Install three Batteries BA-2 and one Battery BA-65 as shown in figure 3.
- (6) Replace the other battery clamping frame and tighten the battery clamping frame screws.
- (7) Disengage the two battery frame hinge pins nearest the row of tubes and swing the battery frame outward, away from the tubes.
- (8) Connect the batteries to the battery terminal board as shown in figure 4.

Note. Battery BA-65 has a two-prong connector-plug receptacle. To insure correct

polarity, be sure that the larger pin of the plug is inserted in the larger hole of the battery receptacle.

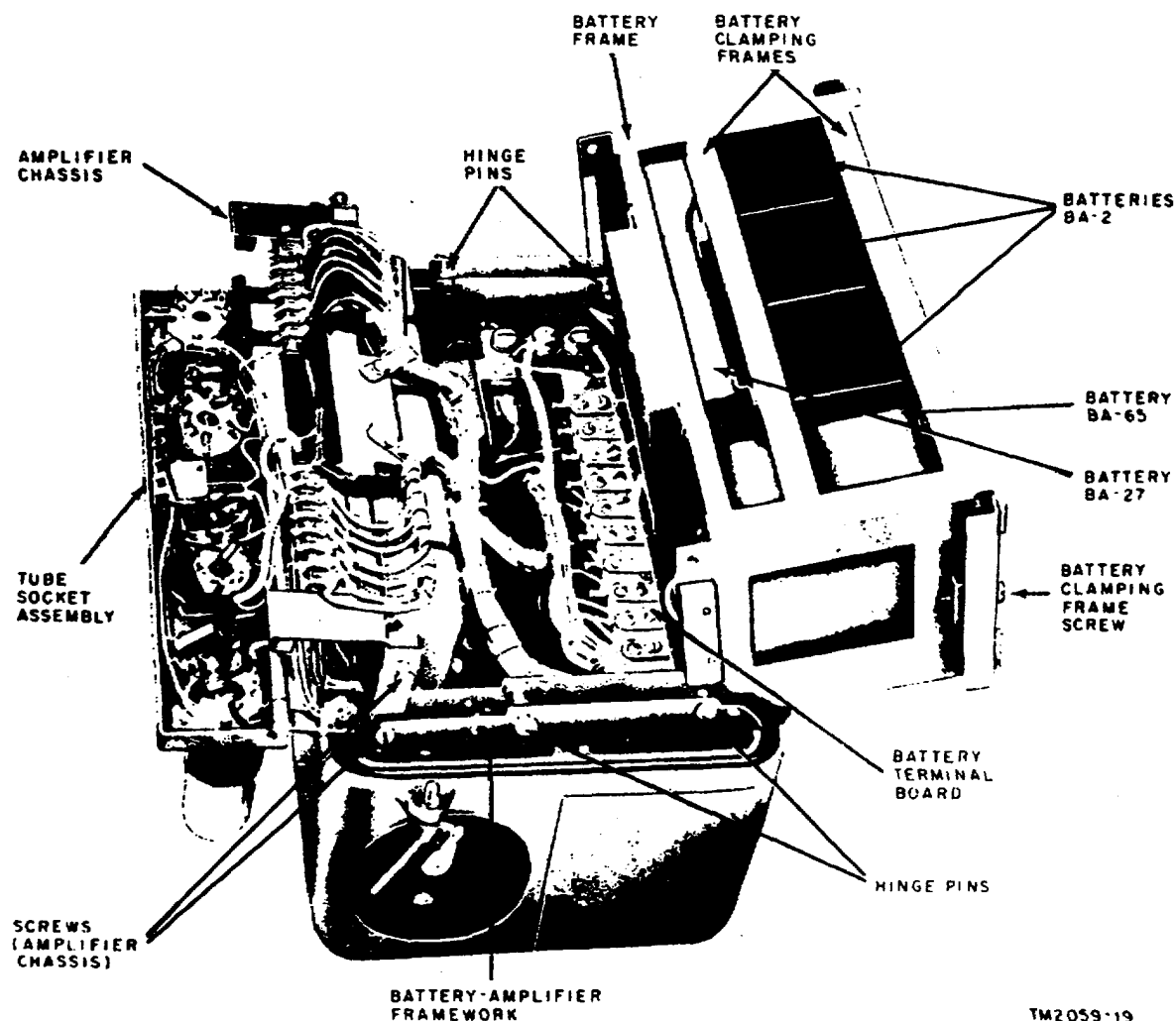
Caution: When not using the telephone, lock the cradle switch lever (fig. 2) in the down position or current will be drawn from the batteries. The cradle switch lever may be locked by pushing it down and moving the latch located beneath it to the left.

- (9) Swing the frame inward, toward the tubes and re-engage the two battery frame holding pins.
- (10) Put the housings together and fasten the screws. Make sure that the gasket separating the upper and lower housings is free from dirt and grit, and that

there are no nicks in the V-edged facing on the lower housing.

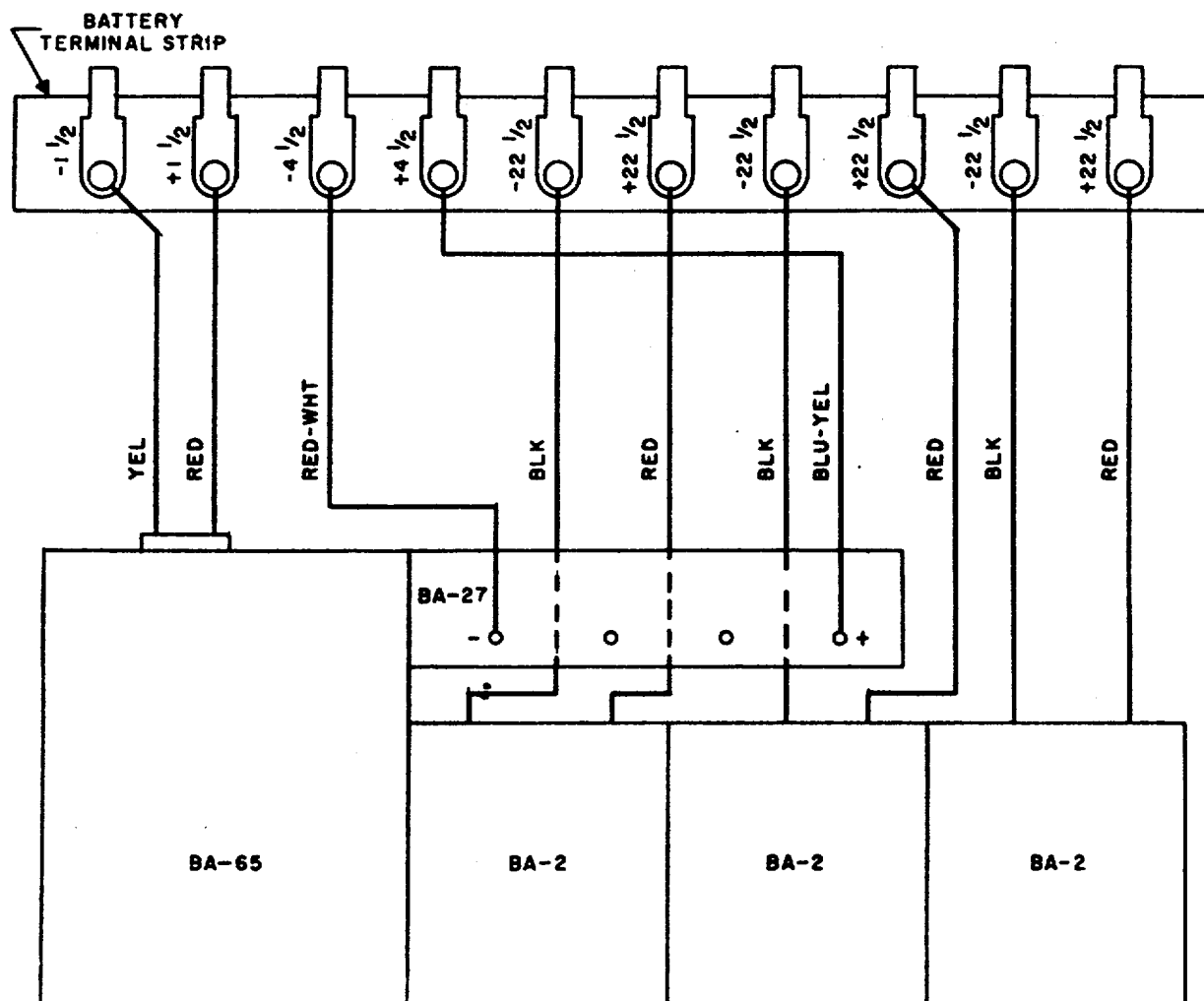
b. Test the amplifiers as follows:

- (1) Remove the handset from the cradle (fig. 2).
- (2) Turn the GAIN control to the maximum clockwise position.
- (3) Release the cradle switch lever by pushing the latch to the right. The cradle switch lever should rise.
- (4) Place the telephone receiver to the ear and tap the side of the housing. Microphonic noise should be heard in the receiver. Press the handset switch and blow into the transmitter. Side tone should be heard in the receiver.



TM2059-19

Figure 3. Upper housing showing battery installation.



TM2059-2

Figure 4. Telephone TP-9 and Telephone Set TA-264/PT, battery connections.

13. Connections

To use the telephone at the end of a line, strip the insulation from the end of the line wires and connect the line wires to the binding posts (fig. 2). To use the telephone at an intermediate

point, bridge the telephone across the line without interrupting the continuity of the circuit. Strip the insulation from the line wires and make a loop connection to the binding posts. Do not cut the line wires.

Section III. OPERATION UNDER USUAL CONDITIONS

14. Controls and Control Functions

Control	Function
GAIN control	Volume control: adjusts volume of sound heard at the receiver in the handset.
Handset switch	Operated, allows speech transmission; unoperated, allows speech reception.
SIG-BELL switch	When set at BELL position, provides audible signal; when set at SIG position, provides visual signal.
Cradle switch lever	When held down, provides transmission and reception without amplification; when released, provides transmission and reception with amplification.

15. Types of Operation

a. The telephones may be used with or without amplification. It is not possible to talk to and hear from the distant station simultaneously. Close cooperation between the talker and listener is necessary for efficient operation.

b. When the telephones are used on a circuit which is connected to a switchboard, a break-in signal (par. 19) may be assumed to be a ring-off signal by the switchboard operator. In this case, it will be necessary to answer the operator's challenge and continue the conversation.

16. Signaling

Turn the generator crank briskly in a clockwise direction to signal another telephone on the line. To receive a signal, set the SIG-BELL switch for the desired type of signal. Set the SIG-BELL switch to BELL for an audible signal; to SIG for a visual signal. If the visual signal is used in darkness, it will be necessary for the operator to note its position by passing his hand over the leaf. The visual signal is a leaf that flies up when ringing current is received.

17. Conversation Without Amplification

To carry on a conversation without amplification, proceed as follows:

a. Remove the handset from the cradle (fig. 2).

b. Lock the cradle switch lever down by pushing the latch to the left.

c. Operate the handset switch and talk into the transmitter.

d. Release the handset switch and listen.

18. Conversation With Amplification

To carry on a conversation with amplification, proceed as follows:

a. Remove the handset from the cradle.

b. Release the cradle switch lever by pushing the latch to the right, allowing the cradle switch lever to rise.

c. Operate the handset switch and talk into the transmitter.

d. Release the handset switch and listen.

e. Adjust the GAIN control to produce the most suitable listening level.

19. Break-in Signal

To interrupt the talker at the distant station, transmit a ringing signal (break-in signal) by turning the generator crank. This will operate the bell or visual signal at the distant station to signal the person talking from the distant station to stop talking immediately and release the handset switch. As soon as the distant station has stopped talking, operate the handset switch and start talking.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

20. General

The efficiency of the telephones can be severely affected in regions where extreme cold, heat, moisture, sand conditions, etc., prevail. Paragraphs 21, 22, and 23 contains information on the operation of the telephones under these unusual conditions.

21. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of the equipment.

a. Dry-cell batteries lose considerable electrical capacity in low temperatures because of decreased chemical activity, and become unusable. Replace Batteries BA-2, BA-27 and BA-65 with the batteries listed in paragraph 7b.

b. Grease on the generator shaft and gears may

freeze. Move equipment to a location in which the grease will thaw. Then clean the generator shaft and gears of grease and relubricate.

c. Moisture may form on the transmitter and receiver. Unscrew the bakelite cap and wipe dry.

d. A receiver exposed to very low temperatures may freeze the operator's ear if he uses the receiver in contact with his ear. Protect the handset transmitter and receiver with Microphone Cover CW-111 to prevent frostbite when the operator's ear may come in contact with the cold receiver cap.

22. Operation in Tropical Climates

When operated in tropical climates, the telephone may be installed in tents, huts, or when necessary, in underground dugouts. When equipment is installed below ground and when it is

set up in swampy areas, it is subjected to more acute moisture conditions than those that are normal in the tropics. Ventilation is usually poor, and the high relative humidity causes condensation to form on the equipment whenever the temperature becomes lower than the surrounding air. Wipe the handset dry with a dry cloth. A special moistureproofing and fungiproofing treatment has been applied during manufacture and provides a reasonable degree of protection.

23. Operation in Desert Climates

Special dustproofing treatment is not necessary for the telephones. Take all possible precautions to keep dust, dirt, and sand from getting on lubricated parts (Generator GN-38-B). Daily inspection and cleaning of the equipment is recommended. Instead of merely adding new lubricants to the generator, clean and relubricate the equipment whenever practicable.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE

Section I. FIRST ECHELON (OPERATOR) MAINTENANCE

24. Scope of Operator's Maintenance

This section contains information on maintenance to be performed by the operator. These procedures do not require special tools or test equipment. This maintenance will consist of routine inspections, cleaning, visual checking, and replacement of batteries. Tubes may be replaced only by substituting a new tube.

25. Tools and Materials

The tools and materials necessary to maintain the equipment at this level are cheesecloth or other lint-free cloth and Tool Equipment TE-33. No other tools, materials or test equipment are necessary at this level of maintenance.

26. Preventive Maintenance

a. *DA Form 11-240.* DA Form 11-240 (fig. 5) is a preventive maintenance checklist to be used by the operator. Items not applicable to the equipment are lined out in the figure. References in the ITEM block in the figure refer to paragraphs which contain additional maintenance information pertinent to the particular item. Instructions for the use of the form appear on the top of the form.

b. *Items.* The information in this subparagraph is supplementary to DA Form 11-240. The item numbers correspond to the ITEM numbers on the form.

Item	Maintenance procedures
1	Remove all kinks from the signal lines and handset cord; inspect the signal line and handset cord for fraying, cuts, and breaks. Report any defects for correction by personnel at higher echelons.
2	Check the signal line connections to the binding posts. Remake the connections if the signal lines do not make good contact at the binding posts.

Item	Maintenance procedures
3	Remove dirt, dust, grease, and moisture from the cord, handset, housings, and battery compartment.
4	Inspect the carrying strap for cuts, tears or fraying. Report any defects for correction by personnel at higher echelons.
5	Remove all corrosion and dead batteries from the battery compartment (para. 12 and 27).
6	Signal the distant station; ask them to signal back. Talk and listen on the circuit and observe transmission quality.
7	Separate the upper and lower housings (par. 12); release the cradle switch lever. Check the tubes for lighted filaments and secure mounting.
8	Same as for item 1 above.
9	Same as for item 2 above.
10	Same as for item 3 above.
11	Inspect the upper and lower housings for chips, cracks, corrosion, rust, broken or missing generator handle. Report any defects for correction by personnel at higher echelons. Remove any moisture, mildew, dirt, or grease.
12	Tighten upper and lower housing screws, handset cord terminal screws on jack assembly, cradle switch lever mounting screw, jack assembly mounting screws, transmitter cap, receiver cap, and cradle screws.
13	Clean the panel markings; remove corrosion.
14	Check the handset for chips or cracks. Report any defects for correction by personnel at higher echelons. Tighten loose caps. Remove dirt, grease, moisture.
15	Examine the snap fastener on the upper housing. Report any defects for correction by personnel at higher echelons.
16	Same as for item 4 above.
17	Inspect the telephone for completeness. One tube is the only running spare supplied.
18	Check the installation site for coolness and dryness.

27. Equipment Performance Checklist

The equipment performance checklist is used to check equipment performance systematically. All corrective measures which the operator can

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT TELEPHONE SET		EQUIPMENT NOMENCLATURE TELEPHONE SET TA-264/PT						
		EQUIPMENT SERIAL NUMBER 1293						
<p>INSTRUCTIONS - This form is to be used by the operator (First echelon) as a daily preventive maintenance check list for Signal equipment in actual operation.</p> <p>1. For detailed preventive maintenance instruction see:</p> <p>a. The Technical Manual (in TM 11 series) for the equipment. (See DA Pamphlet Number 310-4)</p> <p>b. The Supply Bulletin (SB-11-100 series) for the equipment (See DA Pamphlet Number 310-4)</p> <p>c. The Department of the Army Lubrication Order. (See DA Pamphlet Number 310-4)</p> <p>2. The Communication Officer/Chief or his designated representative will take the following action:</p> <p>a. Enter the designation of equipment.</p> <p>b. Strike out items that do not apply to the equipment.</p> <p>c. Hand this form to the individual checking the equipment.</p> <p>3. The individual making the check will enter in the column entitled CONDITION, in line with the ITEM checked, the proper notation regarding the condition, using the symbols specified under LEGEND. At the end of the week's operation the user will sign this form and hand it to the Communication Officer/Chief.</p>								
<p>LEGEND FOR MARKING CONDITIONS:</p> <p>✓ SATISFACTORY ✕ ADJUSTMENT, REPAIR OR REPLACEMENT REQUIRED ⊗ DEFECT CORRECTED</p>								
DAILY		CONDITION						
NR.	ITEM	S	M	T	W	T	F	S
1.	INSPECT CORDS FOR KINKS, FRAYING, CUTS, BREAKS. (Outdoor use) PAR 26b		✓					
2.	INSPECT EXTERIOR CONNECTIONS FOR SNUG FIT AND GOOD CONTACT. (Outdoor use) PAR 13		✓					
3.	CLEAN CORDS, CASES, HANDSET, AND BATTERY COMPARTMENT OF MOISTURE, DIRT, GRIME, SALES-AND , MILDEW, CORROSION. (Outdoor use) PAR 26b		✓					
4.	INSPECT FOR SECURE MOUNTING STRAPS. (Outdoor use) PAR 26b		✓					
5.	INSPECT BATTERY COMPARTMENT FOR CORROSION, GOOD BATTERIES, BROKEN OR MISSING SPRINGS, SALES-AND . (Local battery sets). PAR 26b		⊗					
6.	OPERATE THE TELEPHONE AND CHECK FOR PROPER RINGING AND TALKING. PAR 26b		✓					
7.	INSPECT VACUUM TUBES FOR LIGHTED FILAMENTS AND SECURE MOUNTING. (Amplifier type). PAR 26b		✓					
WEEKLY								
NR.	ITEM	CON- DIT- ION	NR.	ITEM	CON- DIT- ION			
8.	INSPECT CORDS FOR KINKS, FRAYING, CUTS, BREAKS. (Indoor use) PAR 26b		14.	INSPECT HANDSET FOR CHIPS, CRACKS, LOOSE CAPS OR SALES-AND , DIRT, GREASE, MOISTURE. PAR 26b				
9.	INSPECT EXTERIOR CONNECTIONS FOR SNUG FIT AND GOOD CONTACT. (Indoor use) PAR 13		15.	INSPECT SNAP FASTENER ON CASE. (Outdoor use) PAR 26b				
10.	CLEAN CORDS, BATTERY COMPARTMENT, EXTERIOR OF CASE, HOUSING, SALES-AND HANDSET. (Indoor use). PAR 13		16.	INSPECT WEATHER-AND CANVAS ITEMS FOR MILDEW, TEARS, AND FRAYING. PAR 26b				
11.	INSPECT EXTERIOR FOR CHIPS, CRACKS, CORROSION, RUST, MOISTURE, MILDEW, DIRT, GREASE, BROKEN OR MISSING GENERATOR HANDLE. PAR 26b		17.	INSPECT TELEPHONE SET FOR COMPLETENESS - CORDS, SALES-AND , HANDSET, BATTERIES, GENERATORS, TUBES, CARRYING CASES, ACCESSORIES, TECHNICAL MANUALS, RUNNING SPARE PARTS. PAR 26b				
12.	TIGHTEN LOOSE ASSEMBLY AND MOUNTING HARDWARE. PAR 26b		18.	INSPECT FOR PROPER INSTALLATION IN COOL, DRY PLACE. PAR 9				
13.	INSPECT MARKINGS FOR LEGIBILITY, CORROSION. PAR 26b							
<p>19. IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. (Use reverse if additional space is required)</p>								
I HAVE PERFORMED THE REQUIRED MAINTENANCE INSPECTION ON THE ITEMS CHECKED ON THIS FORM.		DATE	SIGNATURE OF INSPECTOR					

DA FORM 11-240 EDITION OF 1 MAY 51 WILL BE USED UNTIL EXHAUSTED

TM2059-5

Figure 5. DA Form 11-240.

perform are given in the corrective measures column. If the action taken by the operator does not correct the fault, additional maintenance is required by personnel at a higher echelon. The operator should note on the repair tag how the equipment performed and what corrective meas-

ures were taken. In using the checklist, start at the beginning, following each step consecutively to locate trouble. However, if trouble is suspected in a particular area, start checking at that point and continue the steps sequentially. Operate the equipment as shown in the checklist below.

Item No.	Item	Action or condition	Normal indications	Corrective measure
PREPARATORY				
1	Batteries	Install batteries as directed in paragraph 12.		
2	Handset	Remove from cradle.		
3	GAIN control	Turn to maximum clockwise position.		
4	Cradle switch lever	Release by pushing latch to right.	Cradle switch lever rises.	Check batteries.
5	Telephone receiver	Place to ear. Tap side of housing.	Microphonic noise heard in receiver.	Check tubes. Higher echelon maintenance required.
6	Telephone transmitter	Press handset switch. Blow into transmitter.	Sidetone heard in receiver.	Check batteries.
7	Telephone at end of line	Connect line wires to binding posts.		Check tubes. Higher echelon maintenance required.
8	Telephone at intermediate points	Bridge telephone across line. Strip insulation from line wires and make loop connection to binding posts.		
START				
9	SIG-BELL switch	Move to BELL for audible signal.		
10	Cradle switch lever (operation without amplification).	Move to SIG for visual signal.		
11	GAIN control (operation with amplification).	Lock by pushing cradle switch lever down and moving latch to left.		
12	Cradle switch lever (operation with amplification).	Turn to midposition. Release by pushing latch to right.	Cradle lever rises.	
EQUIPMENT PERFORMANCE				
13	Signalling circuit	To send signal, turn generator crank clockwise.	Operation of bell or visual signal at distant station.	Check line wires at binding posts. Higher echelon maintenance required.
14	Transmitting circuit (operation without amplification).	Operate handset switch and talk into the transmitter.	Conversation heard at distant station.	Check line wires at binding posts. Check Battery BA-27.
15	Receiving circuit (operation without amplification).	Release handset switch	Conversation heard from distant station.	Higher echelon maintenance required.
16	Transmitting circuit (operation with amplification).	Operate handset switch and talk into transmitter.	Conversation heard at distant station.	Check line wires at binding posts. Check batteries.
				Check tube VI (par. 24). Higher echelon maintenance required.

17	Receiving circuit (operation with amplification).	Release handset switch. Adjust GAIN control for best volume.	Conversation heard from distant station.	Check line wires at binding posts. Check batteries. Check tubes V2 and V3 (par. 24). Higher echelon maintenance required.
STOP	Handset Binding posts Batteries	Replace in cradle. Disconnect line wires. Disconnect battery leads and remove batteries.		

Section II. SECOND ECHELON MAINTENANCE

28. Scope of Second Echelon Maintenance

a. The extent of second echelon maintenance is limited by the tools, materials, test equipment, and by the skill of the personnel.

b. Second echelon maintenance for the telephones consists of the following:

- (1) Visual inspection (par. 31).
- (2) Preventive maintenance (par. 30).
- (3) Replacement of defective tubes (par. 32).
- (4) Troubleshooting (par. 33).

29. Tools, Materials, and Test Equipment

The tools, materials, and test equipment required for second echelon maintenance are listed below.

a. *Tools.* Tool Equipment TE-41.

b. *Materials.* Cleaning cloth.

c. *Test Equipment.*

- (1) Multimeter ME-77/U.
- (2) Electron Tube Test Set TV-7/U.

30. Preventive Maintenance

a. *Use of DA Form 11-241.* DA Form 11-241 (fig. 6) is a preventive maintenance checklist to be used by the second echelon maintenance personnel. Items not applicable to the equipment are lined out in the figure. References in the ITEM block in the figure are to paragraphs which contain additional maintenance information pertinent to the particular item. Instructions for the use of the form appear on the back of the form.

b. *Items.* The information given in this subparagraph is supplementary to DA Form 11-241. The item numbers correspond to the ITEM numbers on the form. Items 1 through 18 are the same as those listed on DA Form 11-240 and described in paragraph 26. Refer to paragraph 26 for maintenance information for these items.

Item	Maintenance procedures
19	Remove all kinks from the signal lines and handset cord; inspect the signal line and handset cord for fraying, cuts, and breaks. Report any defects for correction by personnel at higher echelons.

Item	Maintenance procedures
20	Remove dirt, dust, grease, moisture and mildew from the telephone housings, chassis and battery compartments.
21	Examine all wiring and connections for good contact, breaks, fraying, and cuts. Report any defects for maintenance by personnel at higher echelons.
22	Examine Generator GN-38-B for worn or chipped gears, loose screws or broken contact springs. Report any defects for maintenance by personnel at higher echelons.
23	Generator GN-38-B only; burnish generator contacts.
24	Tighten upper and lower housing screws, handset cord terminal screws on jack assembly, cradle switch lever mounting screw, and jack assembly mounting screws.
25	Operate the SIG-BELL switch, GAIN control, handset switch, and cradle switch. Check for positive action and good contact. Report any defects for maintenance by personnel at higher echelons.
26	Check the tubes for lighted filaments and secure mounting.
30	Clean the cradle switch and SIG-BELL switch. Remove dirt and dust.
31	Clean and tighten the handset cord connections to the jack assembly; clean and tighten the signal line connections to the binding posts.

31. Visual Inspection

a. When failure is encountered and the cause is not immediately apparent, check as many of the items listed in b below as is practicable before starting a systematic operational check of the equipment. Do not disassemble the telephone for a complete inspection without some knowledge of the operational symptoms. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

b. Complete or partial failure of the telephone often may be caused by one or more of the following faults:

- (1) Improper positioning of operating controls.
- (2) Worn, broken, or disconnected signal lines or handset cord.
- (3) Broken or loose wires in chassis and jack assembly.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT TELEPHONE SET			
EQUIPMENT IDENTIFICATION		EQUIPMENT SERIAL NO.	
TELEPHONE SET TA-264/PT		1233	
LEAD IN FOR MAINTENANCE CONDITIONS: <input checked="" type="checkbox"/> Satisfactory; <input type="checkbox"/> Adjustment, repair or replacement required; <input type="checkbox"/> Defect corrected. NOTE: Strike out items not applicable.			
NO.	ITEM	NO.	ITEM
1	INSPECT CORDS FOR KINKS, FRAYING, CUTS, BREAKS. (Outdoor use). PAR 26b	17	INSPECT TELEPHONE SET FOR COMPLETENESS - CORDS, HANDSET, BATTERIES, GENERATORS, TUBES, CARRYING CASES, ACCESSORIES, TECHNICAL MANUALS, RUMBLE SPINE PARTS. PAR 30b
2	INSPECT EXTERIOR CONNECTIONS FOR SNUG FIT AND GOOD CONTACT. (Outdoor use). PAR 13	18	INSPECT FOR PROPER INSTALLATION IN CORD, DRY PLACE. PAR 9
3	CLEAN CORDS, CASKS, HANDSET, AND BATTERY COMPARTMENT OF MOISTURE, DIRT, GRIME, OIL, GREASE, DIRT, CORROSION. (Outdoor use). PAR 30b	19	INSPECT CORDS AND LINE TERMINALS FOR FRAYING, BREAKS, CUTS, PROPER CONNECTIONS FOR SNUG FIT AND GOOD CONTACT. PAR 30b
4	INSPECT FOR SECURE MOUNTING STRAPS. (Outdoor use). PAR 26b	20	CLEAN INTERIORS OF TELEPHONE BOUNDING, CASKS, CARRYING CASES, BATTERY COMPARTMENTS OF ALL CORROSION, MOISTURE, DIRT, GRIME, EXCESS SOLIDS, DIRT, GRIME, GREASE. PAR 30b
5	INSPECT BATTERY COMPARTMENT FOR CORROSION, SOAK BATTERIES, INSURE ON MISSING SWINGS, BATTERIES. (Local battery use). PAR 26b	21	INSPECT INTERIOR WIRING AND CONNECTIONS FOR GOOD CONTACT, BREAKS, CUTS, FRAYING. PAR 30b
6	OPERATE THE TELEPHONE AND CHECK FOR PROPER RUNNING AND TALKING. PAR 26b	22	INSPECT GENERATOR FOR WORK ON CHIPPED GEARS, LOOSE SCREWS, WORN RUBBER, BROKEN CONTACT SWINGS. (Local battery use). PAR 30b
7	INSPECT VACUUM TUBES FOR LIGHTED FILAMENTS AND SECURE MOUNTING. (Amplifier type). PAR 26b	23	BURNISH GENERATOR CONTACTS AND ADJUST SWINGS. (Local battery use). PAR 67
8	INSPECT CORDS FOR KINKS, FRAYING, CUTS, BREAKS. (Indoor use). PAR 26b	24	TIGHTEN ALL LOOSE ASSEMBLY AND MOUNTING SCREWS. PAR 30b
9	INSPECT EXTERIOR CONNECTIONS FOR SNUG FIT AND GOOD CONTACT. (Indoor use). PAR 26b	25	INSPECT HAND-OPERATED, REMOTE-OPERATED, HANDSET BUTTERFLY SWITCH AND CONTROL SWITCHES FOR POSITIVE ACTION AND GOOD CONTACT. PAR 30b
10	CLEAN CORDS, BATTERY COMPARTMENT, EXTERIOR OF CASE, BOUNDING, CASKS, HANDSET. (Indoor use). PAR 26b	26	INSPECT VACUUM TUBES FOR SECURE MOUNTING, VISIBLE DAMAGE, AND LIGHTED FILAMENT. (Amplifier type). PAR 30b
11	INSPECT EXTERIOR FOR CHIPS, CRACKS, CORROSION, RUST, MOISTURE, DIRT, GRIME, OIL, GREASE, BROKEN OR MISSING GENERATOR HANDLE. PAR 26b	27	WASHER-PLATE AND JACKS FOR GOOD FIT AND GOOD CONTACT. PAR 30b
12	TIGHTEN LOOSE ASSEMBLY AND MOUNTING HARDWARE. PAR 26b	28	WASHER-PLATE AND JACKS OF RUST, CORROSION, DIRT, GRIME, OIL, GREASE. PAR 30b
13	INSPECT WIRING FOR LOOSENESS, CORROSION. PAR 26b	29	WASHER-PLATE AND JACKS FOR GOOD FIT AND GOOD CONTACT. PAR 30b
14	INSPECT HANDSET FOR CHIPS, CRACKS, LOOSE CAPS ON CAPSULES, DIRT, GREASE, MOISTURE. PAR 26b	30	CLEAN SWITCHES AND BOUNDING OF DIRT, RUST AND MOISTURE. PAR 30b
15	INSPECT SNAP FASTENER ON CASE. (Outdoor use). PAR 26b	31	CLEAN AND TIGHTEN ALL TERMINAL CONNECTIONS. PAR 30b
16	INSPECT HANDSET AND CARRYING CASES FOR HILLOCK, TEARS, AND FRAYING. PAR 26b	32	LUBRICATE THE EQUIPMENT GEARS AND LARGEST GEARS. PAR 63
		33	INSPECT THE TELEPHONE SET FOR PROPER MOISTURE AND FUNGUS PROOFING. PAR 30b
34 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.			

DA FORM 11-241

REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

16-44387-1

TM2059-6

Figure 6. DA Form 11-241.

- (4) Defective tubes.
- (5) Overheated capacitors.
- (6) Burned insulation and resistors.

32. Tube Testing and Replacement

When trouble occurs, check all connections and batteries before removing any tubes. Try to isolate the trouble to a component or stage. If tube failure is suspected, use the applicable procedure below to check the tubes.

a. Using Tube Tester. Remove and test one tube at a time. Discard a tube only if its defect is obvious or if the tube tester shows it to be defective. Do not discard a tube that tests at or slightly below its minimum test limit. Replace the original tube, or install a new one if required, before testing the next one.

b. Tube Substitution Method. Replace a sus-

pected tube with a new tube. If this does not correct the trouble, remove the new tube and put back the original tube. Repeat this procedure with each suspected tube until the defective tube is located.

33. Troubleshooting by Using Equipment Performance Checklist

The equipment performance checklist (par. 27) gives an action or condition, normal indications, and corrective measures information which will help the organizational repairman locate trouble in the equipment. To use this list, follow the items in numerical sequence. When the procedure referred to in the corrective measures column is beyond the scope of organizational personnel, troubleshooting at a field maintenance level is required.

CHAPTER 4

THEORY

34. General

The telephones are equipped with vacuum-tube amplifiers in both the transmitting and receiving circuits. They can be used without amplification, as local battery sets. The distance over which satisfactory telephone communication can be accomplished is limited by the attenuation of the line, noise, crosstalk, and other interference present in the circuit. To extend the range, a transmitting amplifier is used to apply stronger signals on the line, and thereby provides a more favorable signal-to-noise ratio. To compensate for the losses in the line, amplifiers in the receiving circuit are used. The receiving amplifiers increase the communication range, provided that a good signal-to-noise ratio is maintained.

35. Amplification

a. In the telephones, amplifiers are self-contained. The transmitting circuit uses one stage of amplification; the receiving circuit uses two stages of amplification. To provide a more favorable signal-to-noise ratio, the speech energy originating at the transmitter is amplified and sent out on the line at a comparatively high level (15 decibels referred to 1 milliwatt in 600 ohms (dbm input)). The speech energy received at the telephone terminals is amplified through two stages of amplification to provide a maximum gain of approximately 55 decibels (db).

b. Losses caused by the capacitive effects in the line increase at higher frequencies. To overcome these losses, the receiving amplifiers of the telephones are designed to provide greater amplification at higher voice frequencies (fig. 7). In this way, an equalizing action is obtained which results in a satisfactory overall frequency response characteristic.

c. Transmission of speech energy from both ends of the line simultaneously is not possible when the amplifier is used. The coupling of energy between the transmitting and the receiving amplifiers would cause oscillation and make

conversation unintelligible. The handset is equipped with a nonlocking type switch which must be operated for transmission and released for listening. A relay in the telephone is operated by the handset switch and makes the receiving circuit inoperative during transmission, and the transmitting circuit inoperative when speech is being received.

d. The handset rests in a cradle and operates a cradle switch lever. Filament circuits are completed to ground through contacts 11 and 12 of switch S1 (fig. 21) when the handset is removed from the cradle and the cradle switch lever is up. When the cradle switch lever is held down (a latch is provided) and the handset removed from the cradle, the telephone is used as a local battery set (without amplification).

36. Local Battery Operation

When the telephone is to be used without amplification (as a local battery set), the cradle switch lever is locked down. This action closes the switch S1 contacts 4 and 6 in the transmitting circuit and 7, 8, and 10 in the receiving circuit. Contacts 11 and 12 are opened and disconnect the filament voltage from the amplifier tubes.

37. Receiving Circuit Without Amplification (fig. 8)

Incoming speech signals at the binding posts (line terminals) of the telephone flow through contacts 4 and 6 of cradle switch S1, winding 1-3 of transformer T1, and capacitor C6 to the receiver of the handset. From the receiver in the handset, the currents flow through contacts 7 and 10 of switch S1 and capacitor C5B back to the line.

38. Transmitting Circuit Without Amplification (fig. 9)

a. When the handset switch is closed, a complete circuit for Battery BA-27 is formed through winding 2-3 of transformer T1 and winding 1-5

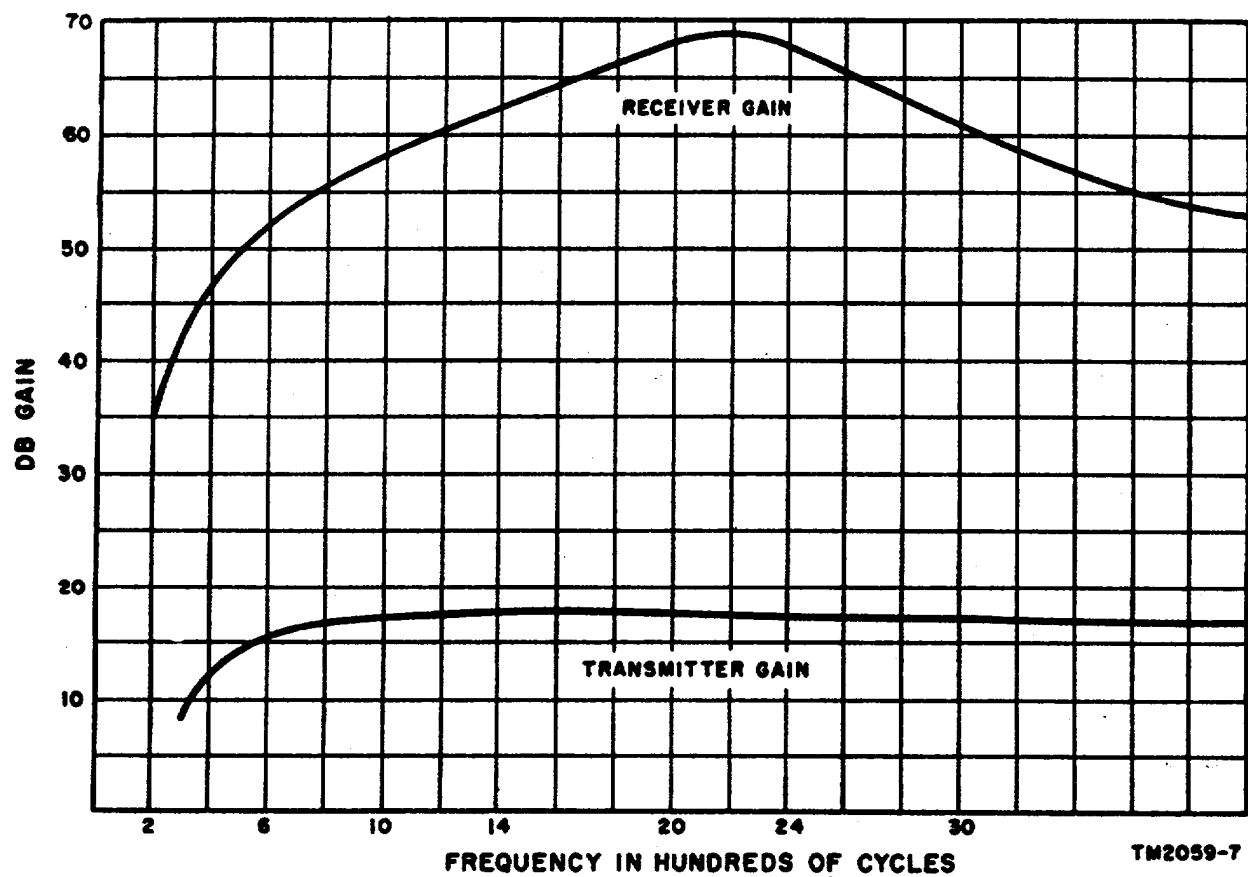


Figure 7. Amplifier gain characteristics.

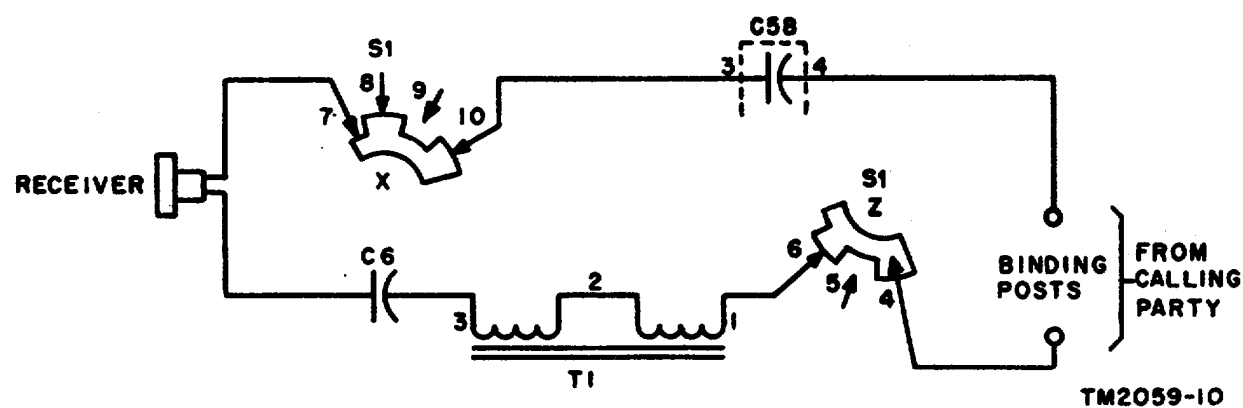


Figure 8. Receiving circuit without amplification, simplified schematic diagram.

of relay K1. Speech currents from the transmitter are induced in windings 2-1 and 3-4 of transformer T1. They are applied to the line from terminal 1 of the transformer through contacts 6 and 4 of switch S1, and from terminal 4 through resistor R4, capacitor C5A, contacts 8 and 10 of switch S1, and capacitor C5B.

b. When the telephone is used without amplification, sidetone is heard in the receiver. The circuit for the sidetone voltage is as follows: transmitter currents are induced in winding 3-4 of transformer T1. These currents flow to the receiver from terminal 3 through capacitor C6, and from terminal 4 through resistor R4, capacitor C5A, and contacts 8 and 7 of switch S1.

39. Transmitting Circuit With Amplification (fig. 10)

a. The transmitting circuit is energized when the handset switch is operated and the cradle switch lever is up (par. 35d). Current for energizing the transmitter is fed from the positive side of Battery BA-27 through the handset switch, the transmitter, winding 5-1 of relay K1, and winding 3-2 of transformer T1, to the negative side of Battery BA-27. Relay K1 operates, opens contacts 2-3, and removes the short from winding 1-2 of transformer T2.

b. Speech currents originating in the transmitter flow through winding 3-2 of transformer T1 and are induced in secondary winding 5-6. From the secondary winding of the transformer, the speech currents are applied to the

grid of transmitting amplifier tube V1. Primary winding 1-2 of transformer T2 forms the load impedance for tube V1. (On some Telephones TP-9, serial numbers above 5,000, and on Telephone Sets TA-264/PT, a 56,000-ohm resistor (R13) has been added between terminals 1-2 of transformer T2.) The output from the transmitting amplifier is induced in secondary winding 4-3 of the transformer and applied to the line binding posts through cradle switch S1, transformer T3 and capacitor C5B. Although the energy induced in winding 3-4 of transformer T3 is supplied to the grid of tube V2, the tube has been made inoperative by the operation of relay K1.

c. Sidetone is heard in the receiver when the telephone is being used with amplification and handset switch is operated (closed). Closed contacts 3-4 of relay K1 allow positive battery to be applied directly to the plate of first receiving amplifier tube V2. This places a short across load impedance network L1, making the receiving amplifier inoperative. This condition exists as long as the handset switch is held operated. Since the transmitting and receiving amplifiers use a common plate voltage supply, the internal voltage drop in the battery is used to provide sidetone in the receiver. The voltage drop in the battery, caused by the change in current in the transmitting amplifier, is applied to the grid of tube V3, and to the receiver through output transformer T4, and contacts 9 and 7 of switch S1. Bypass capacitor C7 con-

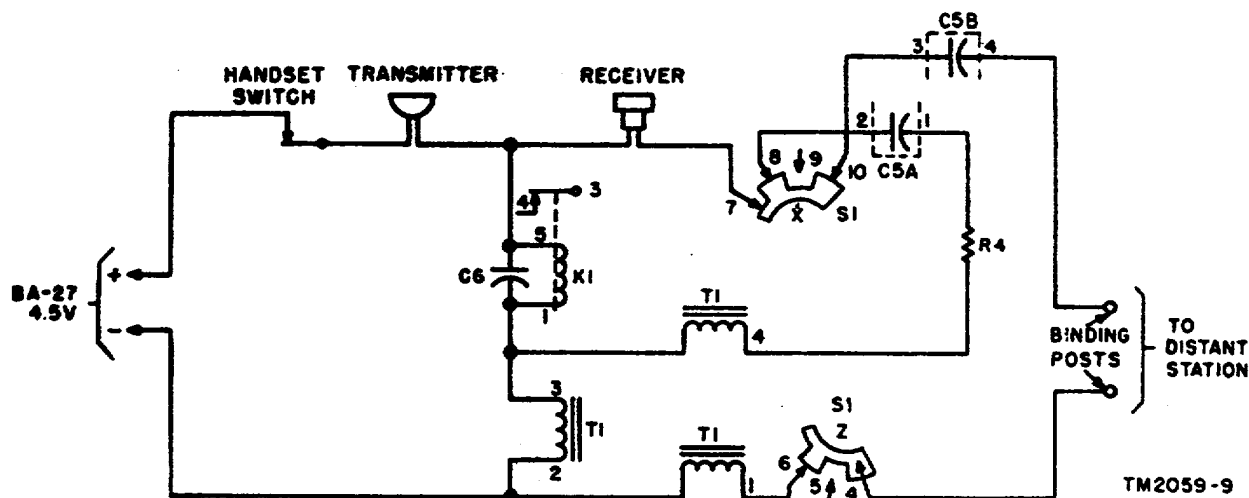


Figure 9. Transmitting circuit without amplification, simplified schematic diagram.

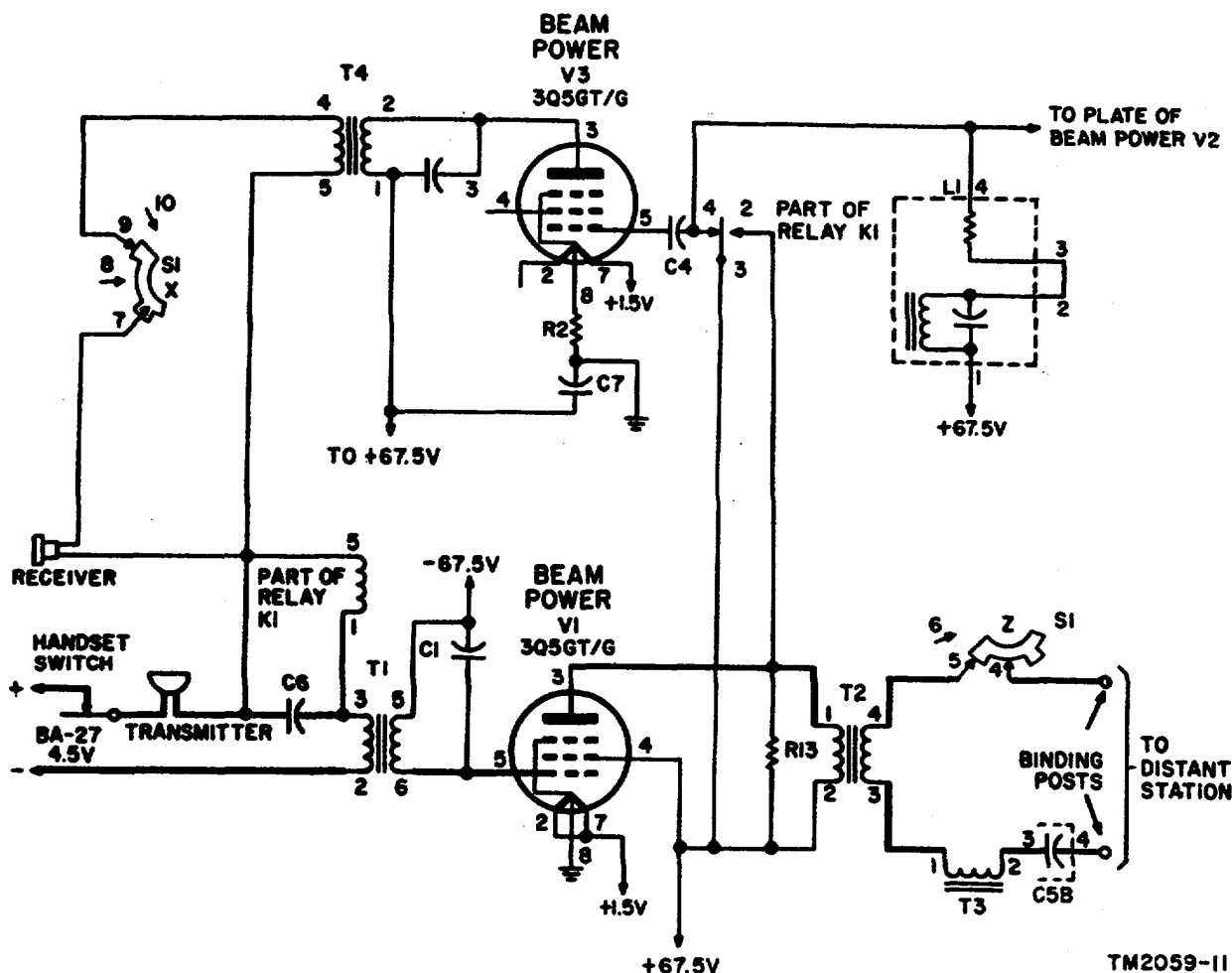


Figure 10. Transmitting circuit with amplification, simplified schematic diagram.

trols the amount of sidetone applied to the receiver.

40. Receiving Circuit With Amplification (fig. 11)

a. Relay K1 is not energized when the handset switch is released (for listening). Amplification is applied to the circuit when the cradle switch lever (S1) is up. The transmitting circuit is made inoperative by a short across primary winding 1-2 of transformer T2 through contacts 2-3 of relay K1. This condition exists as long as the handset switch is released.

b. Incoming speech currents at the line terminals of the telephone flow through capacitor C5B, winding 1-2 of transformer T3, and winding 3-4 of transformer T2. The energy induced

in secondary winding 3-4 of transformer T3 passes to the grid of first amplifier tube V2 through GAIN potentiometer R12 and grid resistor R8. Potentiometer R12 controls the gain of the receiving amplifier by varying the loss in the input circuit of tube V2.

c. The network consisting of choke L1 and its capacitor and resistor form the load impedance of tube V2. The parallel circuit formed by choke L1 and the capacitor has a resonant frequency of about 2,200 cycles, and at this point the first stage amplifier has its maximum gain. On either side of this frequency, the gain will decrease as shown in figure 7. This design provides compensation for the line losses over the essential voice frequency bandwidth.

d. The amplified signals from the first stage are coupled to the grid of tube V3 through

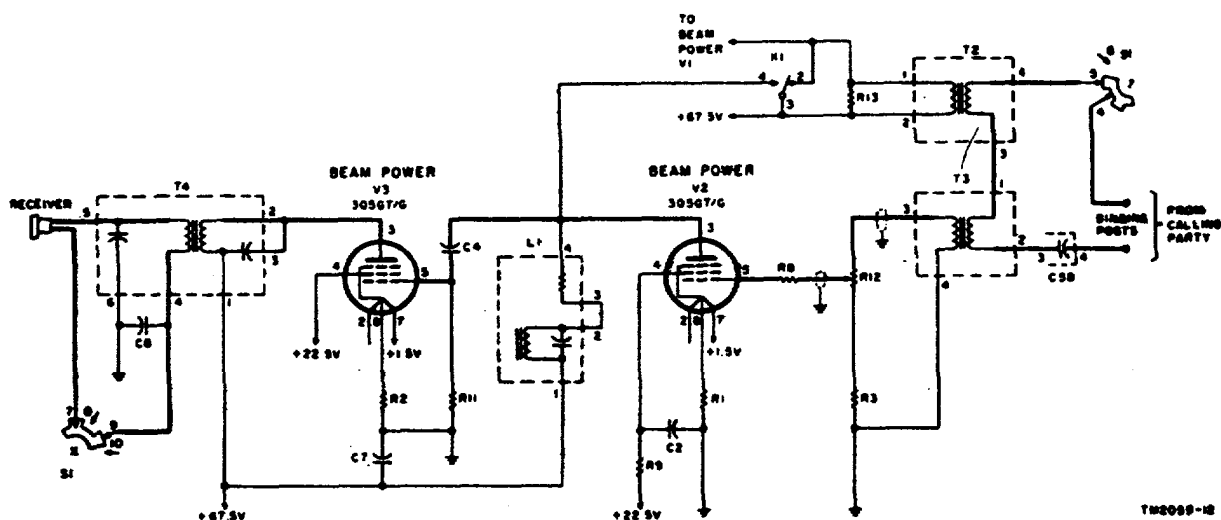


Figure 11. Receiving circuit with amplification, simplified schematic diagram.

capacitor C4. The signals are further amplified by tube V3 and are transformer-coupled to the handset receiver by transformer T4. Primary winding 1-2 of transformer T4 forms the load impedance for tube V3. The output signals induced in winding 4-5 of the transformer are applied to the handset receiver through contacts 9 and 7 of cradle switch S1.

c. The power supply for the receiving amplifier consists of a 1½-volt battery (BA-65) which supplies filament voltage to the tubes, and three 22½-volt batteries (BA-2) which supply plate voltage to the tubes (fig. 21). The negative side of the batteries is grounded through contacts 1, 11, and 12 of switch S1.

Note. The term *ground* applies to a common return point on the terminal strip in the amplifier chassis.

41. Signaling Circuit (fig. 12)

a. *Incoming.* Ringer MC-131 is connected to the line through generator contacts 2 and 3 when SIG-BELL switch S2 is in the BELL position (contacts 2 and 3 of S2 closed). The visual signal indicator is connected to the line

through generator contacts 2 and 3 when SIG-BELL switch S2 is in the SIG position (contacts 1 and 2 of S2 closed). The ringer and the visual signal coils both offer high impedance to voice-frequency currents and low impedance to low-frequency signaling currents.

b. *Outgoing.* Outgoing signaling currents, originating within the hand generator when the hand generator crank is turned, are sent out on the line through contacts 1 and 3 of the hand generator. The closing of contacts 1 and 3 simultaneously opens the circuit (contacts 3 and 2 of the generator) to the ringer and the visual signal indicator.

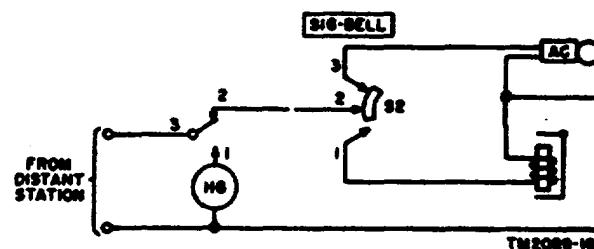


Figure 12. Signaling circuit, incoming, simplified schematic diagram.

CHAPTER 5

FIELD MAINTENANCE

Section I. GENERAL TROUBLESHOOTING INFORMATION

42. General

The first step in servicing a defective equipment is to sectionalize the fault. Sectionalization means tracing the fault to the major component or to the circuit responsible for abnormal operation. The second step is to localize the fault. Localization means tracing the fault to the defective subchassis, circuit, or stage. Isolation means tracing the fault to the defective part. Some faults such as burned-out relay coils, relay contacts, resistors, etc, often may be isolated by inspection. The majority of faults, however, must be isolated by checking voltages and resistances.

43. Localizing Trouble

a. Troubles in a system in which the telephones are used may occur either in the line wires or in the telephone itself. In general, an indication of the condition of the line and the telephone can be determined to some extent by the ringing signals. If a ringing signal is received, but it is impossible to hear over the circuit, the telephone may be at fault. If no ringing signals or speech signals can be received, the line may be at fault. Noisy operation may occur as a result of trouble in either the line or the telephone.

b. When trouble is encountered, a quick check may be made by changing the telephone to local battery operation (par. 17). This check is especially useful for determining the origin of trouble causing noisy operation, and also for checking the condition of the amplifiers. This check will be satisfactory only when losses in the circuit are not excessive. A more reliable

way of testing the telephone is to disconnect it from the line and connect it to a telephone which is known to be in working order. Telephone TA-43/PT or TA-312/PT may be used for this purpose.

c. After the trouble has been localized to either the line or the telephone, proceed to isolate the trouble.

- (1) If it has been determined that the line is at fault, report the trouble to wire maintenance personnel.
- (2) If the trouble is in the telephone, follow the procedure outlined in the troubleshooting chart (par. 44). To further assist in locating trouble in the telephone, schematic diagrams (figs. 21 and 22), wiring diagram (fig. 23), a point-to-point voltage chart (par. 45), and a resistance chart (par. 46) are supplied.

44. Troubleshooting Chart

The most common troubles that occur in the telephones together with a listing of the probable causes and the corrective action, are given in the following chart. This list of troubles does not represent all the troubles that might occur or all the probable causes for each condition, but does include those which occur in the majority of cases. The probable causes or the items in which the causes may be found are listed under each heading. The references included after the corrective action furnish a cross-reference to paragraphs in other sections of this manual.

Symptom	Probable trouble	Correction
Incoming speech signals weak, or no sound heard in receiver (with amplification).	Line wires.....	Check signal line connections at binding posts (par. 13). Report line wire trouble to wire maintenance personnel.
	Cradle switch S1 locked in down position.	Push latch to unlock cradle switch.
	Batteries weak or dead.....	Test voltage of batteries with voltmeter. (Test should be made under actual load conditions.) If voltage is less than two-thirds of rated voltage (par. 7), replace batteries.
	Defective vacuum tubes.....	Test tubes V2 and V3. Replace faulty tubes.
	Defective handset and/or cord	Replace handset (par. 51) and/or cord (par. 52).
	Defective relay K1.....	Check continuity through relay K1. Replace faulty relay (par. 61).
	Defective cradle switch S1....	Check contacts of cradle switch S1. If contacts are defective and cannot be satisfactorily cleaned or adjusted, replace switch (par. 58).
	Defective bell or visual signal leaf.	Change setting of SIG-BELL switch. If speech can come through on new setting, check bell or drop, as the case may be. Replace defective bell (par. 55) or visual signal leaf coil (par. 60).
No speech output, or speech output weak (with amplification).	Amplifier circuit.....	Make voltage and resistance measurements (para. 45 and 46). Make any necessary repairs as indicated by voltage and resistance measurements.
	Cradle switch S1 locked in down position.	Push latch to unlock cradle switch.
	Batteries weak or dead.....	Test voltage of batteries with voltmeter. (Test should be made under actual load conditions.) If voltage is less than two-thirds of rated voltage (par. 7), replace batteries.
	Defective vacuum tube.....	Test amplifier tube V1. Replace tube if necessary.
	Defective handset and/or cord	Replace handset (par. 51) and/or cord (par. 52).
	Defective relay K1.....	Check continuity through relay K1. Replace faulty relay (par. 61).
	Defective cradle switch S1....	Check contacts of cradle switch S1. If contacts are defective and cannot be satisfactorily cleaned or adjusted, replace switch (par. 58).
	Transmitting amplifier circuit	Make voltage and resistance measurements (para. 45 and 46). Make any necessary repairs as indicated by voltage and resistance measurements.
High noise level prevails (with amplification).	Line wires grounded.....	Report line wire trouble to wire maintenance personnel.
	Defective vacuum tubes.....	Replace each vacuum tube until noise ceases.
	Defective batteries.....	Replace batteries.
	Loose connections.....	Check all soldered connections, switch contacts, and relay contacts. Make any necessary repairs as determined by the above inspection.
Incoming speech signals weak, or no sound heard in receiver (without amplification).	Line wires.....	Check line wire connections at binding posts. Report line wire trouble to wire maintenance personnel.
	Cradle switch S1 in unlocked position.	Push cradle switch S1 down; push latch to lock cradle switch down.
	Defective handset and/or cord	Replace handset (par. 51) and/or cord (par. 52).
	Defective cradle switch S1....	Check contacts of cradle switch S1. If contacts are defective and cannot be satisfactorily cleaned or adjusted, replace switch (par. 58).
	Defective bell or visual signal leaf.	Change setting of SIG-BELL switch. If speech can come through on new setting, check bell or visual signal leaf, as the case may be. Replace defective bell (par. 55) or visual signal leaf (par. 60).

Symptom	Probable trouble	Correction
No speech output, or speech output weak (without amplification).	Cradle switch S1 in unlocked position. Battery BA-27 weak or dead.	Push cradle switch S1 down; push latch to lock cradle switch down. Test voltage of battery with voltmeter. (Test should be made under actual load conditions.) If voltage is less than two-thirds of rated voltage (par. 7), replace battery.
	Defective handset and/or cord Defective relay K1-----	Replace handset (par. 51) and/or cord (par. 52). Check continuity through relay K1. Replace faulty relay (par. 61).
	Defective cradle switch S1---	Check contacts of cradle switch S1. If contacts are defective and cannot be satisfactorily cleaned or adjusted, replace switch (par. 58).
High noise level prevails (without amplification).	Line wires grounded----- Defective Battery BA-27----- Loose connections-----	Report line wire trouble to wire maintenance personnel. Replace battery. Check all soldered connections, switch contacts, and relay contacts. Make any necessary repairs as determined by the above inspection.
Visual signal or bell does not operate, depending on the setting of the SIG-BELL switch.	Line wires----- Defective bell or visual signal	Check line wire connections at binding posts. Report line wire trouble to wire maintenance personnel. Check resistance between binding posts. (Resistance should be 1,300 ohms.) Replace coils if necessary. Check the ringer and clapper (par. 66). Check the visual signal leaf.
	Defective switch on generator	Check switch contacts on generator. Adjust if necessary (par. 67). If trouble is not corrected, replace generator (para. 53 or 54).
No ringing current-----	Defective generator-----	Check switch contacts on generator. Adjust if necessary (par. 67). If trouble is not corrected, replace generator (para. 53 or 54).

45. Point-to-Point Voltages

The cradle switch lever should be in the released (up) position. Terminal points listed in the From column in the chart below are at a

positive potential. Terminal points listed in the To column are at a negative potential.

Note. Measurements listed below were taken with Multimeter TS-352A/U, using the 20,000-ohm-per-volt scale.

From—	On	To—	On	Remarks	TP-4	TA-304/PT
3	V1	Grd	Chassis	Handset switch operated	65	65
3	V1	Grd	Chassis		60	60
4	V1	Grd	Chassis		65	65
7	V1	6	T1		2.2	5
2	V1	Grd	Chassis	Handset switch operated	1.5	1.5
3	T1	2	T1		.1	.1
7	V2	Grd	Chassis		1.5	1.5
3	V2	Grd	Chassis		42	50
4	V2	Grd	Chassis		.1	7
7	V2	8	V2		1.32	1.32
7	V3	Grd	Chassis		1.5	1.5
3	V3	Grd	Chassis		58	60
4	V3	Grd	Chassis		.5	14
7	V3	8	V3		1.32	1.32

46. Point-to-Point Resistance Values

From—	On	To—	On	Sw	Pos	Remarks	TP-9	TA-84/FT
Bind. Post	Panel	Bind. Post	Panel	S2	SIG	Armature of relay K1 in operated position. (Handset switch operated.)	1,300	1,300
Bind. Post	Panel	Bind. Post	Panel	S2	BELL		1,300	1,300
4	T2	3	T2	S1	Down		40	56
1	T2	2	T2	S1	Down		0	0
1	T2	2	T2	S1	Down	Maximum GAIN control. Disconnect all wires from terminal 3 of T3.	1,250	1,050
3	V1	Grd	Chassis	S1	Up		0	0
5	V1	6	T1	S1	Up		56,000	56,000
5	T1	6	T1	S1	Up		22	170
1	T1	2	T1			Minimum GAIN control. Disconnect all wires from terminal 3 of T3.	24	24
2	T1	3	T1				2.5	2
3	T1	4	T1				22.5	19
1	T3	2	T3				28	43
5	V2	Grd	Chassis			Armature of relay K1 in operated position. (Handset switch operated.)	400,000	400,000
5	V2	Grd	Chassis				150,000	140,000
3	T3	4	T3				1,790	1,100
7	V1	7	V2				0	0
7	V2	7	V3			Maximum GAIN control. Disconnect all wires from terminal 3 of T3.	0	0
8	V2	Grd	Chassis				4	3
4	V2	4	V3				740,000	240,000
3	V2	2	L1	S1	Down		22,000	21,000
1	L1	2	L1	S1	Down	Armature of relay K1 in operated position. (Handset switch operated.)	820	1,100
3	V2	1	L1				0	0
5	V3	Grd	Chassis				470,000	490,000
2	T4	1	T4	S1	Down		1,580	1,000
3	V3	Grd	Chassis			Maximum GAIN control. Disconnect all wires from terminal 3 of T3.	4	3
4	T4	5	T4	S1	Up		30	18
4	T4	5	T4	S1	Down		55	35
1	K1	5	K1				50	46

Section II. REMOVAL AND REPLACEMENT

47. General

a. Most assemblies of the telephone should be removed before they are dismantled for repairs. This section describes the recommended procedure for removal and replacement of defective parts for the telephone. It does not duplicate information on preventive maintenance contained in paragraphs 24 through 33. Except in cases of extreme emergency, all removal and replacement should be completed by personnel thoroughly trained in telephone maintenance.

b. It may be necessary to unsolder connections to transformers, capacitors, resistors, switches, and the gain control when they are removed and replaced. When replacing apparatus on any of the units, be careful not to drop excess solder on other parts or wiring terminals. *Use only rosin-core solder. Avoid all soldering pastes or acids.*

48. Removal and Replacement of Upper and Lower Housing

It is necessary to remove the lower housing to check, remove, and replace batteries and tubes; to troubleshoot the amplifier circuits of the telephone; and to remove and replace other components of the telephone such as the bell, generator, visual signal leaf coils, switches, capacitors and resistors.

a. Removal.

- (1) Place the telephone in the normal upright position on a work bench or other suitable area.
- (2) Loosen the four screws (two in front, one on each side) that hold the two housings together.
- (3) Lift the upper housing (which contains all of the components) from the lower housing.
- (4) Place the upper housing on the work bench in an inverted manner (on its top) so that the tubes and batteries are up.

b. *Replacement.* Replace the housings by reversing the procedure outlined in a above.

49. Removal and Replacement of Battery Frame (fig. 3)

a. Removal.

- (1) Remove the lower housing (par. 48a).
- (2) Disengage the two (one on each end) hinge pins nearest the amplifier chassis. Swing the battery frame up on the remaining two hinge pins and away from the tubes.
- (3) Disconnect all battery connections to battery terminal board (if batteries are installed).
- (4) Disengage the remaining two hinge pins and remove the battery frame.

b. *Replacement.*

- (1) Replace the battery frame by reversing the procedure outlined in a (2) through (4) above.
- (2) Replace the lower housing (par. 48b).

50. Removal and Replacement of Amplifier Chassis (fig. 3)

a. Removal.

- (1) Remove the lower housing (par. 48a).
- (2) Remove the (four) screws (two at each end) that hold the amplifier chassis to the battery-amplifier framework attached to the casting. Remove the amplifier chassis.
- (3) Move the amplifier chassis aside and unsolder all connections for a complete removal of the amplifier chassis.

b. *Replacement.*

- (1) Replace the amplifier chassis by reversing the procedure outlined in a (2) and (3) above.
- (2) Replace the lower housing (par. 48b).

51. Removal and Replacement of Handset (fig. 2)

a. Removal.

Note. The handset includes the cord.

- (1) Place the telephone in the normal operating position, with the upper housing cover open.
- (2) Remove the cord fastener screw from the jack assembly and remove the cord fastener on Telephone Set TA-264/PT.